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Review Article

Epidemiology of Pasteurellosis in Small Ruminants

Bidjeh Kebkiba*

Livestock Research Institute for Development, Republic of Chad

***Corresponding Author:** Bidjeh Kebkiba, Livestock Research Institute for Development, Republic of Chad.

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Abstract

A purely respiratory disease of sheep and goats, pasteurellosis is a disease caused by the bacteria called *Pasteurella haemolytica*. In fact, *Pasteurella* are commensal bacteria found in the mucous membranes of the upper respiratory tract and digestive tract of mammals and birds. In humans these bacteria are responsible for diseases caused by pathogens associated with animals. The prevalence of *pasteurella* is high in animals, which remain healthy carriers in many cases; all animals are concerned (domestic livestock, wild and xotic). The usual inhabitant of the oropharyngeal flora microbiota, its local abundance is significant. Indeed, pasteurellosis is an infection of domestic animals caused by various species of *pasteurella* resulting in hemorrhagic septicemia, which can exceptionally affect humans. The presence of respiratory syndrome, where *pasteurella* is strongly involved, is reported all over Africa, but very little quantified assessment is made about its prevalence and even less about its economic impact. This manuscript summarizes, from bibliographic references, the epidemiological data on Pasteurellosis in general and that of small ruminants in particular.

Keywords: Small Ruminants; Pasteurellosis; *Pasteurella;* Pneumopathy; Sheep; Goats

Introduction

Small ruminants occupy an important place in livestock systems around the world. They are animals that adapt more easily to the difficult conditions encountered in the Sahelian zone. The breeding of these animals constitutes a significant nutritional contribution, because their milk and meat provide a significant part of the protein intake of rural populations [1]. Very prolific and hardy species, small ruminants constitute an easily mobilized cash-flow for current expenses. Finally, they allow breeders in developing countries a capitalization often used during epizootic phenomena decimating the cattle herd. Production disorders in ewes and goats therefore constitute a factor limiting the profitability of this breeding [2]. According to Traoré [4], small ruminants could contribute more to the betterment of breeders if they do not pay a heavy price for the pathology. Although the livestock sub-sector contributes a lot to the national economy in some African countries, its development is hampered by various constraints such as infectious diseases like peste des petits ruminants, goat and sheep pox, pasteurellosis [3-5] quote only those. Indeed, pasteurellosis is one of the main constraints and the major concern of the production of small ruminants in the world in general and in Sahelian Africa in particular. Eradicating pasteurellosis will therefore help improve food security, nutrition, incomes and livelihoods for million of poor farmers around the world. There are many infectious diseases of animals and many of them are of public health significance, resulting in morbidity and mortality. These diseases are the main causes of economic losses in animal production in general and small ruminants in particular. Among these is pasteurellosis, which is an infectious disease of humans and many animal species and is economically important. These infections are considered responsible for respiratory pathologies in small ruminants [2-5]. Indeed, pasteurellosis is one of the main constraints and the major concern of the production of small ruminants in the world in general and in Sahelian Africa in particular. Eradicating pasteurellosis will therefore help improve food security, nutrition, incomes and livelihoods for million of poor farmers around the world.

There are many infectious diseases of animals and many of them are of public health significance, resulting in morbidity and

mortality. These diseases are the main causes of economic losses in animal production in general and small ruminants in particular. Pasteurellosis is a common disease in animals and humans caused by inoculation of bacteria.

Pasteurellosis manifests as a localized and painful inflammatory reaction. It is caused by a bacterium called "Pasteurella multocida". It is a commensal bacterium of the respiratory, digestive and genital mucous membranes of mammals and birds. It is found on these surfaces under normal conditions. This bacterium is very sensitive to temperature changes and desiccation. This is why it survives very poorly in the outside environment.

Based on the results of zootechnical and health monitoring undertaken in Mali, pneumopathies are considered responsible for 40 to 60% of deaths observed in goats and 10 to 40% in sheep [6-8]. In addition, surveys carried out in Chad, Nigeria and Senegal have shown a prevalence varying between 20 and 60% of the causes of mortality in small ruminants in general and more than 50% of the causes of death in goats in particular [2,5].

Serological surveys carried out in Senegal [10], in Mauritania [11], in Mali [3], revealed the presence of peste des petits ruminants (PPR), adenovirus, goat and sheep pox, para-influenza-3 (PI-3), contagious ecthyma, Blue Tongue and infectious bovine rhinotracheitis (IBR). However, these authors noted a notable variation in the prevalence of these germs. It should also be noted that primary viral attacks are always relayed by secondary bacterial and mycoplasmic infections [5,10,11]. In goats, respiratory pathology can sometimes cause significant economic losses, through the number of patients, and the loss of unmarketed milk following antibiotic treatment - all the more so as the numbers increase. It is sometimes an emergency illness, when many animals are affected. Although the disease has been eradicated in most developed countries, its incidence is little known in developing countries, as it is associated with other infections causing pneumonia syndrome in small ruminants. The disease affects domestic animals, wildlife, and humans. It affects the respiratory system of animals, leading to loss of productivity, such as reduced milk production, abortion, weak offspring, weight loss. It thus constitutes an obstacle to internal and external trade. The presence of respiratory syndrome, where *pasteurella* is strongly involved, is reported all over Africa, but very little quantified assessment is made about its prevalence and even less about its economic impact. The objective of this manuscript is to summarize from bibliographic references the epidemiological data on Pasteurellosis in general and that of small ruminants in particular.

Epidemiology

Etiology of the disease

In order to understand the processes by which infectious diseases occur, it is essential to know the agents that are responsible for them.

Pasteurellosis is an infectious disease of animal or human caused by germs of the genus *Pasteurella*. Pasteurelles are small gram-negative bacilli of the Pasteurellaceae family, which also includes bacteria of the genus *Actinobacillus Mannheimia*, *Aggregatibacter*, *Haemophilus* and *Avibacterium*. Pasteurelles are isolated in animals as well as in humans. They are commensal germs or opportunistic pathogens, but they are also responsible for serious infections. The first diagnostic investigations in herds of small ruminants monitored in Mali led to consider pasteurellosis as the cause of the significant mortalities noted in the cold season in the area [12].

Although the classification of pasteurellaceae has recently been modified, four species are involved in human pathology.

- *Pasteurella multocida,*
- *Pasteurella dagmatis,*
- *Pasteurella canis,*
- *Pasteurella stomatis.*

In animals, this bacterium is found involved in many other respiratory diseases such as:

- Avian cholera, where it causes sepsis with fever and greenish diarrhea;
- Atrophic rhinitis of swine, which causes nosebleeds, lung problems and atrophy of the pig's muzzle;
- Cattle hemorrhagic septicemia, where it causes fever, swelling of the throat and chest, followed by complications;
- Pneumonia in several animal species;
- Bronchopneumonia in ruminants and pigs;
- Coryza, pneumonia or abscess under the skin;
- Rabbit arthritis, where it damages the joints.

Susceptible animals

The animals concerned are domestic animals, farm animals and exotic wild animals. According to Merchand and Barner [13] pasteurellosis affects cattle, sheep, goats and pigs. According to the same authors, a particularly serious form of pasteurellosis, called hemorrhagic septicemia, affects cattle and domestic buffaloes.

Clinical manifestations of the disease

The clinical signs usually observed are fever with congestion of the mucous membranes, decreased appetite and decreased production for dear adults. We can observe coughing, sneezing, throwing in these animals. Symptoms can be very subtle, especially on young goats. And we also sometimes observe overacute pasteurellosis on nursing kids, sometimes very young (septicemia starting from the lungs). At autopsy, areas of purple red, dark red, firm to the touch, are seen in the anterior and cardiac lobes of the lungs.

In a study undertaken in Mali, Traoré [4] found the following symptoms: the goat with the disease was dehydrated and had sunken eyes; a marked depression in two days of illness, white mucous membranes, dry, with profuse diarrhea, nauseating, with droppings of a whitish color; hyperthermia with a temperature of 39°9 C; the muzzle of the goat was dry and slightly cracked.

In humans, once the bacteria enters the body, often after a bite or scratch, it will produce endotoxin. This toxin causes localized necrosis around the site of inoculation. This then results in:

- A rapid, intense and painful inflammatory reaction;
- A red and painful swelling appears at the injection site of the bacteria;
- Purulent oozing from the wound, which has difficulty in healing;
- The peripheral lymph nodes are enlarged.

If the infection is not treated quickly, it can spread throughout the body, causing fever syndrome and then sepsis. If the inoculation takes place at a location close to a joint, then the bacteria can cause bone and joint complications, but this is rare.

Sources and modes of transmission of the disease

Transmission to humans occurs through contact with nasopharyngeal secretions or saliva of animals during bites, scratches (this is called inoculating pasteurellosis) or licking wounds. This bacterium can be transmitted to humans from animals in which it causes the same symptoms. Pasteurelles are isolated in 50% of dog bites, 75% of cat bites. People in contact with animals can carry the germ in the oropharynx.

Factors favoring transmission to humans are all situations favoring close contact with animals. The usual habitat of the oropharyngeal flora microbiota where its local abundance is important. The cat also transmits the so-called cat scratch disease. This bacterial infection develops after a scratch from a carrier and shedding cat. It manifests as a painful wound.

In humans *P. Multocida* is most often isolated and can be responsible for both acute and chronic infections. Mortality from *pasteurella* remains rare in humans, however, in animals, the impact on morbidity and mortality is not negligible.

Geographical distribution

Pasteurellosis is found all over the world, often causing significant economic losses. According to Merchant and Barner [13], this disease is often observed in animals for slaughter (fattening for example).

In tropical Africa, this disease is considered to be a major pathology both in humid areas such as Nigeria [15,21] and in Sahelian areas such as in Senegal [5,19,20], in Mauritania [11], in Mali [3,4,16,18].

Diagnosis

Clinical diagnosis

The diagnosis of pasteurellosis can be made from the clinical signs observed in animals. However, only the laboratory can confirm or deny the diagnosis.

Laboratory diagnosis

Three methods are used to establish the laboratory diagnosis. One can first of all look directly for the germ in the blood or the pus, for the generalized forms, and in the serosity appearing at the level of the wound, in the case of bite; this research must be done very early, both by culture and by subcutaneous inoculation into the mouse, which is very sensitive to this germ. After gram staining, bipolar bacteria are observed under the microscope. A second method uses the intradermal reaction to Relly's "pasteurellin"; this perfectly specific reaction is positive from the eighth day of the disease.

Finally, seroagglutination or passive hemagglutination is used. But the results of these serological tests are much more inconsistent than those of the first two methods.

The diagnosis of Pasteurellosis can be made in the laboratory after your doctor or veterinarian has taken a sample from the infected lesion. The sample is then cultured for 24 to 48 hours. After this time, the bacteria involved in the infection can be identified.

Differential diagnosis

In the field, clinically, pasteurellosis is often confused with respiratory tropic infections such as: parinfluenza 3 (PI-3) and adenovirus, but these germs are only responsible for benign disorders, except during co-infections with *pasteurella* or mycoplasmas. It is also confused with peste des petits ruminants (PPR), foot-and-mouth disease, sheep pox, goat pox (respiratory form) and contagious caprine pleuropneumonia (CCPP). However, it should be noted that pasteurellosis is a purely respiratory disease of sheep and goats caused by the bacterium *Pasteurella haemolytica*. There are no oral lesions. The number of animals affected by the disease, which die is generally lower than in the case of PPR, with the exception of certain cases observed under special stressful conditions such as in a high concentration of animals, for example. the gathering of animals for trade and around water points. The problem of differential diagnosis arises particularly with the forms of PPR where oral lesions and diarrhea are absent or mildly present. Using suitable culture media, *Pasteurella haemolytica* bacteria are easily isolated from lung samples. However, the isolation of the bacterium *Pasteurella haemolytica* from the lungs of sick animals does not confirm the existence of a primary infection of pasteurellosis, nor the exclusion of the presence of PPR, since very often pasteurellosis is a complication of the PPR. Diagnostic tests for the detection of the PPR virus should also be performed in all cases of suspected pasteurellosis this also applies to contagious caprine pleuropneumonia caused by mycoplasmas.

Treatment and prophylaxis

The treatment of pasteurellosis is done with broad-spectrum antibiotics, which will help eliminate the bacteria. They should be given systemically to animals, often as injections. In addition to this general treatment, proper disinfection of the inoculation area should be carried out. For this, disinfection with chlorhexidine or betadine is indicated. You may need to prevent the animal from licking itself with a collar or moon collar. With the right treatment, the prognosis for this disease is quite good. The few cases of complications that exist involve wounds in hard-to-reach places, such as the joints, and where antibiotics will have difficulty spreading.

In parallel with autopsy samples for isolation of the germ in question and antibiogram, the very rapid implementation of antibiotic and anti-inflammatory treatment is essential to limit losses (mortality and morbidity).

Concerning medical prophylaxis, there is in animals a vaccine against *Pasteurella*, which is produced from the bacteria killed (inactivated vaccine). But, due to the low severity of Pasteurellosis for our pets, it is only used in animals production.

After laboratory diagnosis, the hypothesis of contagious caprine pleuropneumonia (CCPP), a disease very similar to pasteurellosis, can be ruled out. Thus, Traoré [16] was able to determine the treatment to be administered. He also made the following recommendations. The herd of goats can be treated with an antibiotic based on *Tylosin* 20%. This offers the maximum chance of eliminating germs with a respiratory tropism such as *pasteurella*. However, reveals Traoré [4,14], veterinarians generally use *Oxytetracycline* 20% to treat this type of disease. In all cases, antibiotic treatment may be set up pending the result of the bacterial culture and the antibiogram.

In Mali and Chad, the annual campaign to combat legally contagious diseases takes into account pasteurellosis through the annual vaccination of small ruminants. Unfortunately, this contagious, deadly infectious disease still affects herds of small ruminants. If it is affected, advises Traoré [4] the entire herd should be vaccinated against pasteurellosis in small ruminants with the inactivated vaccine.

Risk factors

The risk factors for pasteurellosis are numerous: it can be recent purchases of animals, sudden stress during transport, reorganization of batches or weaning, overcrowded housing, viral infections, a building with a present atmosphere. limits - large day-night temperature differentials; high humidity or ammonia content; or even the increase in the herd requires an enlargement of the building: an additional volume is created but sometimes disorganizes the air circulation with the appearance of lateral air currents or cold air fall on the animals. A vaccine can be used, intended to prevent ovine pasteurellosis; the advantage is that it is directed against

several strains of *pasteurella Mannheimia haemolytica*, including type A2, which is dominant in goats. It reduces overall mortality, but does not replace improvements made to the atmosphere and ventilation of buildings.

From the observations made in the zone of central Mali by Killanga [17], the type of habitat can be considered to be very important in the aetiopathogenesis of pasteurellosis: animals kept in mud enclosures whose sleeping areas are located inside the concessions seem less affected than those parked in more open spaces.

Conclusion

Pasteurellosis is an infectious disease that affects both domestic and wild animals. *Pasteurella* are Gram-negative bacilli commensal to the upper respiratory tract of mammals and the digestive tract of birds. It can be transmitted to humans through bites and scratching by infected animals. The most common species in Africa is *pasteurella multocida*. It is this species that affects sheep, goats and cattle. It is also transmitted to humans. The target and vulnerable populations are: breeders, slaughterhouse staff, veterinarians and diagnostic laboratory staff.

The application of sanitary measures combined with mass vaccination campaigns makes it possible to control or eradicate animal pasteurellosis in a country.

Pasteurellosis is found all over the world, often causing significant economic losses. It is defined as a symptomatic infection, the causative agent of which is a bacteria called *pasteurella*. These bacteria are commensal germs (opportunistic pathogens).

In humans, *Pasteurella Multocida* is most often isolated and can be responsible for both acute and chronic infections. Mortality from *pasteurella* remains rare in humans. In contrast, in animals, the impact on morbidity and mortality is considerable.

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Conflict of Interest

Author declares here that there is no conflict of interest.

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Volume 4 Issue 12 December 2021